



Sughrue

SUGHRUE MION ZINN MACPEAK &amp; SEAS, PLLC

July 6, 2001

**BOX PCT**

Commissioner for Patents  
Washington, D.C. 20231

PCT/JP00/00055  
-filed January 11, 2000

Re: Application of Hiroyuki TANAKA, Masanori HASEGAWA,  
Tsuyoshi NOGUCHI and Katsuhiko HIGASHINO  
CROSSLINKABLE ELASTOMER COMPOSITION AND MOLDED ARTICLE  
PRODUCED FROM SAME

**Assignee: DAIKIN INDUSTRIES, LTD.**  
Our Ref: Q65251

Dear Sir:

The following documents and fees are submitted herewith in connection with the above application for the purpose of entering the National stage under 35 U.S.C. § 371 and in accordance with Chapter II of the Patent Cooperation Treaty:

- an executed Declaration and Power of Attorney.
- an English translation of the International Application.
- a Notification Concerning Submission or Transmittal of Priority Document.
- an International Preliminary Examination Report (foreign language).
- an English translation of Article 34 amendments (annexes to the IPER).
- an executed Assignment and PTO 1595 form.
- a Form PTO-1449 listing the ISR references, and a complete copy of each reference.
- a Preliminary Amendment.

It is assumed that copies of the International Application, the International Search Report, the International Preliminary Examination Report, and any Articles 19 and 34 amendments as required by § 371(c) will be supplied directly by the International Bureau, but if further copies are needed, the undersigned can easily provide them upon request.

Assignment for published patent application is: **DAIKIN INDUSTRIES, LTD.**



Sughrue

SUGHRUE MION ZINN MACPEAK &amp; SEAS, PLLC

The Government filing fee, after entry of the Preliminary Amendment, is calculated as follows:

Total claims	<u>18</u>	-	20	=		x \$18.00 =	\$0.00
Independent claims	<u>1</u>	-	3	=		x \$80.00 =	\$0.00
Base Fee							\$860.00

<b>TOTAL FILING FEE</b>	<u><u>\$860.00</u></u>
<b>Recordation of Assignment</b>	<u><u>\$ 40.00</u></u>
<b>TOTAL FEE</b>	<u><u>\$900.00</u></u>

Checks for the statutory filing fee of \$860.00 and Assignment recordation fee of \$40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16, 1.17 and 1.492 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from January 12, 1999 based on Japanese Application No. 5862/1999.

Respectfully submitted,

Abraham J. Rosner  
Registration No. 33,276

SUGHRUE, MION, ZINN,  
MACPEAK & SEAS, PLLC  
2100 Pennsylvania Avenue, N.W.  
Washington, D.C. 20037-3213  
Telephone: (202) 293-7060  
Facsimile: (202) 293-7860

Date: July 6, 2001

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hiroyuki TANAKA, et al.

Appln. No.: Unassigned Group Art Unit: Unassigned

Confirmation No.: Unassigned Examiner: Unassigned

Filed: July 6, 2001

For: CROSSLINKABLE ELASTOMER COMPOSITION AND MOLDED ARTICLE  
PRODUCED FROM SAME

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination and following entry of the Article 34 Amendment, please amend the  
above-identified application as follows:

**IN THE CLAIMS:**

Please enter the following amended claims:

1. (Amended) A crosslinkable elastomer composition which comprises a crosslinkable elastomer component and a metal oxide filler containing a silicon oxide filler in an amount of not less than 60% by weight; said silicon oxide filler has a content of impurity metals other than silicon of not more than 100 ppm which is measured under the following conditions:
  - (i) the silicon oxide filler is dispersed and dissolved in 50% hydrofluoric acid and is diluted with ultrapure water; and

**PRELIMINARY AMENDMENT**

**U.S. Appln. No. - National Stage Entry of PCT/JP00/00055**

(ii) contents of metals of the solution are determined through atomic absorption analysis by using an atomic absorption photometer.

3. (Amended) The crosslinkable elastomer composition of Claim 1, wherein said silicon oxide filler has quartz crystal structure.

4. (Amended) The crosslinkable elastomer composition of Claim 1, wherein said silicon oxide filler is blended in an amount of from 1 to 150 parts by weight on the basis of 100 parts by weight of the elastomer component.

5. (Amended) The crosslinkable elastomer composition of Claim 1, which contains a crosslinking agent and said silicon oxide filler in amounts of 0.05 to 10 parts by weight and 1 to 150 parts by weight, respectively on the basis of 100 parts by weight of the elastomer component.

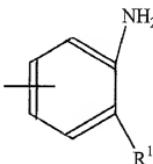
6. (Amended) The crosslinkable elastomer composition of Claim 1, wherein the elastomer component is a fluorine-containing elastomer.

9. (Amended) The crosslinkable elastomer composition of Claim 6, wherein the crosslinking agent is an organic peroxide.

10. (Amended) The crosslinkable elastomer composition of Claim 6, wherein the crosslinking agent is a compound having at least two functional groups represented by the formula (I):

**PRELIMINARY AMENDMENT**

**U.S. Appln. No. - National Stage Entry of PCT/JP00/00055**



wherein R<sup>1</sup> is any one of OH, NH<sub>2</sub> or SH.

11. (Amended) A molded article obtained by crosslinking the elastomer composition of Claim 1.

15. (Amended) The molded article of Claim 11, wherein the article is used for a semiconductor manufacturing equipment.

**PRELIMINARY AMENDMENT**

**U.S. Appln. No. - National Stage Entry of PCT/JP00/00055**

**REMARKS**

Entry and consideration of this Amendment is respectfully requested.

Respectfully submitted,



Abraham J. Rosner  
Registration No. 33,276

SUGHRUE, MION, ZINN,  
MACPEAK & SEAS, PLLC  
2100 Pennsylvania Avenue, N.W.  
Washington, D.C. 20037-3213  
Telephone: (202) 293-7060  
Facsimile: (202) 293-7860

Date: July 6, 2001

405902/0 \* 00669988560

**PRELIMINARY AMENDMENT**  
**U.S. Appln. No. - National Stage Entry of PCT/JP00/00055**

**APPENDIX**

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE CLAIMS:**

The claims are amended as follows:

1. (Amended) A crosslinkable elastomer composition which comprises a crosslinkable elastomer component and a metal oxide filler containing a silicon oxide filler in an amount of not less than 60% by weight; said silicon oxide filler has a content of impurity metals other than silicon of not more than 100 ppm which is measured under the following conditions:

The (i) the silicon oxide filler is dispersed and dissolved in 50% hydrofluoric acid and is diluted with ultrapure water; and

Contents (ii) contents of metals of the solution are determined through atomic absorption analysis by using an atomic absorption photometer.

3. (Amended) The crosslinkable elastomer composition of Claim 1 or 2 Claim 1, wherein said silicon oxide filler has quartz crystal structure.

4. (Amended) The crosslinkable elastomer composition of any of Claims 1 to 3 Claim 1, wherein said silicon oxide filler is blended in an amount of from 1 to 150 parts by weight on the basis of 100 parts by weight of the elastomer component.

5. (Amended) The crosslinkable elastomer composition of any of Claims 1 to 4 Claim 1, which contains a crosslinking agent and said silicon oxide filler in amounts of 0.05 to 10 parts by weight and 1 to 150 parts by weight, respectively on the basis of 100 parts by weight of the elastomer component.

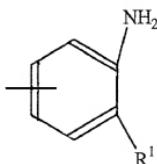
**PRELIMINARY AMENDMENT**

**U.S. Appln. No. - National Stage Entry of PCT/JP00/00055**

6. (Amended) The crosslinkable elastomer composition of any of Claims 1 to 5 Claim 1, wherein the elastomer component is a fluorine-containing elastomer.

9. (Amended) The crosslinkable elastomer composition of Claim 6 or 7 Claim 6, wherein the crosslinking agent is an organic peroxide.

10. (Amended) The crosslinkable elastomer composition of Claim 6 or 8 Claim 6, wherein the crosslinking agent is a compound having at least two functional groups represented by the formula (I):



wherein R<sup>1</sup> is any one of OH, NH<sub>2</sub> or SH.

11. (Amended) A molded article obtained by crosslinking the elastomer composition of any of Claims 1 to 10 Claim 1.

15. (Amended) The molded article of any of Claims 11 to 14 Claim 11, wherein the article is used for a semiconductor manufacturing equipment.

-1-  
DESCRIPTION

CROSSLINKABLE ELASTOMER COMPOSITION  
AND MOLDED ARTICLE PRODUCED FROM SAME

5

TECHNICAL FIELD

The present invention relates to a clean crosslinkable elastomer composition which can give a molded article to be used for a semiconductor manufacturing equipment, for example, a sealing member to be used for sealing of the semiconductor manufacturing equipment, and relates to a molded article which is obtained from the composition, is excellent in plasma resistance, has an excellent property of inhibiting elution of metals and has a reduced content of impurity metals.

15

BACKGROUND ART

In manufacturing semiconductor elements, very high cleanliness is required, and the requirements for high cleanliness range over not only management of a production process of semiconductors but also a semiconductor manufacturing equipment itself and parts of such equipment. Even if the parts of semiconductor manufacturing equipment are cleaned after built in the equipment, a degree of possible cleanliness is limited. Such parts are required to have been cleaned highly before built in the equipment. Contamination which becomes a problem particularly in the production of semiconductors is caused by fine particles, organic compounds and elution of metals which have an adverse effect on accurate etching treatment.

Also high cleanliness is required similarly in a molded article such as a sealing member for semiconductor manufacturing equipment which the present invention can be particularly suitably applied to. The present applicants have attained high cleanliness of the sealing member itself by employing a special method of cleaning the sealing member after molding (WO99/49997).

Such a sealing member is produced by crosslinking a crosslinkable elastomer composition such as a rubber, and in order to provide the sealing member with mechanical properties, there is a case where a metal oxide filler such as a titanium oxide or silicon oxide is added to the composition.

Also in production of semiconductors, there is a case where a dry process such as oxygen plasma ashing is carried out. In that dry process, there is a case where particles (impurity fine particles) are generated from a molded article produced from an elastomer. Those contaminating sources must be eliminated.

Further in production of semiconductors, besides the dry process, there is a wet process employing ultrapure water, hydrochloric acid, and the like. In that wet process, it is necessary to lower elution of impurity metals approximately to zero.

An object of the present invention is to provide a crosslinkable elastomer composition containing a metal oxide filler which has a reduced content of impurity metals, is excellent in plasma resistance and has an excellent property of metal-elution inhibition.

Further the present invention relates to a molded article which can be obtained by crosslinking the above-mentioned composition and is excellent in plasma resistance.

Still further the present invention relates to a molded article which can be obtained by crosslinking the above-mentioned composition and has an excellent property of metal-elution inhibition, particularly relates to a sealing member for sealing of a semiconductor manufacturing equipment.

#### DISCLOSURE OF INVENTION

Namely the present invention relates to the crosslinkable elastomer composition which comprises an elastomer component and a metal oxide filler containing a silicon oxide filler in an amount of not less than 60 % by weight, in which the silicon oxide filler contains impurity metals other than silicon in an amount of not more than 100 ppm.

According to the present invention, the crosslinkable elastomer composition obtained by adding a specific silicon oxide filler to a fluorine-containing elastomer component or silicone elastomer component can give a molded article having excellent mechanical properties. Further the molded article for semiconductor manufacturing equipment which is excellent in plasma resistance and has a very high cleanliness and an excellent property of metal-elution inhibition can be obtained by a special cleaning process disclosed in the above-mentioned WO99/49997, namely a process for cleaning with ultrapure water, a process for cleaning with a clean organic liquid at a cleaning temperature or with a clean inorganic aqueous solution, a dry etching cleaning process or an extractive cleaning process.

25

#### BEST MODE FOR CARRYING OUT THE INVENTION

It is preferable that the metal oxide filler used in the present

invention has a higher content of silicon oxide filler, preferably not less than 60 % by weight, further not less than 75 % by weight. It is particularly preferable that the silicon oxide filler is used solely.

Examples of a suitable silicon oxide filler, particularly a silicon oxide filler which gives an excellent plasma resistance to a molded article are, for instance, high purity synthetic quartz, high purity synthetic silica, and the like.

Particularly a high purity synthetic quartz having quartz crystal structure is excellent in chemical resistance (for example, acid resistance). When applying a molded article produced from a fluorine-containing elastomer to the wet process by using pure water, a fluorine ion is dissociated unavoidably from the fluorine-containing elastomer. Such a dissociated fluorine ion is incorporated into the high purity synthetic quartz before released into a processing equipment. Thus the high purity synthetic quartz functions like an acid acceptor, and formation of a hydrofluoric acid can be inhibited. Examples of such a high purity synthetic quartz are, for instance, 1-FX available from Kabushiki Kaisha Tatsumori (high purity synthetic quartz spheroidal silica), and the like. Examples of the high purity synthetic silica are, for instance, SO-E1, SO-E2, SO-E3 and SO-E4 available from Kabushiki Kaisha Tatsumori, and the like.

A preferred silicon oxide filler is one which contains impurity metals other than silicon in an amount of not more than 100 ppm, preferably not more than 70 ppm, further preferably not more than 50 ppm, particularly preferably not more than 10 ppm.

An average particle size of the metal oxide of the present invention is from about 0.05  $\mu\text{m}$  to about 10.0  $\mu\text{m}$ , preferably from 0.1 to

5.0  $\mu\text{m}$ .

It is preferable that the metal oxide filler other than the silicon oxide filler is a metal oxide containing impurity metals other than the metal or metal oxide in an amount of not more than 100 ppm, preferably 5 not more than 50 ppm, and preferably having a pH value adjusted to 5.0 to 11.0. It is preferable that the metal of the metal oxide is at least one of titanium, cobalt, iron, aluminum, chromium, zinc, tungsten and molybdenum.

The metal oxide filler other than the silicon oxide filler which 10 has a reduced content of impurity metals can be obtained by treating a starting metal oxide filler through extraction with an acid to reduce impurity metal contents in the metal oxide filler, and then treating the filler with alkali to neutralize the remaining acid.

As the other metal oxides which are optional components in 15 the present invention, there are an oxide of one kind of metal, a composite metal oxide containing two or more kinds of metals and a metal hydroxide which is changeable to a metal oxide. It is preferable that a contained metal is at least one of titanium, cobalt, iron, aluminum, chromium, zinc, tungsten and molybdenum. Impurity metals to be 20 eliminated by extraction mean those other than the metal constituting the metal oxide. It is preferable that particularly alkali metals such as sodium, potassium and lithium, copper and nickel are not contained in the filler from the viewpoint of not lowering yield of semiconductor elements.

25 Examples of the metal oxides are, for instance, metal oxides comprising a single metal such as  $\text{TiO}_2$ ,  $\text{Co}_3\text{O}_4$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{WO}_3$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{MoO}_3$  and  $\text{Fe}_2\text{O}_3$ ; composite metal oxides thereof; and the like. Among

05839506, 07/26/01

them,  $TiO_2$ ,  $Al_2O_3$ ,  $Cr_2O_3$  and  $ZnO$  are preferred from the viewpoint of excellent effect of reinforcement, and particularly preferred is  $TiO_2$ .

The other metal oxide filler as an optional component in the present invention is a metal oxide which contains impurity metals other than the metal of metal oxide in an amount of not more than 100 ppm, preferably not more than 70 ppm, further preferably not more than 50 ppm, particularly preferably not more than 30 ppm. A reduction of impurity metal contents may be carried out by treating a starting metal oxide with an acid such as sulfuric acid, nitric acid, hydrofluoric acid or hydrochloric acid to extract impurity metals.

In the present invention, in case where the metal oxide filler is acid, in order not to cause a crosslinking failure even if the filler is added to a crosslinkable elastomer composition, the filler is subjected to treating for neutralizing an acid which exists in the treated metal oxide and causes a failure of crosslinking with a peroxide crosslinking agent. The neutralizing treatment may be carried out with an alkali. It is preferred to avoid the use of alkali containing metals from the viewpoint of elimination of contamination sources. Examples of the preferred alkali are, for instance, an aqueous ammonia, basic amines such as triethanolamine, triethylamine and diethylamine, an ammonia gas, and the like. Particularly from the viewpoint of easy handling, separation and removal, an aqueous ammonia having a concentration of 1 to 28 % by weight is preferred. By the neutralizing treatment, a pH value which is from 2.0 to 4.0 after the acid treatment is increased to 5.0 to 11.0. A preferred pH value is from 5.0 to 9.0.

The neutralizing treatment may be carried out by dipping a filler in an alkaline solution because it is easy, or may be carried out by

spraying an alkaline solution.

Further it is preferable that after the neutralizing treatment, the filler is washed with a clean chemical solution such as ultrapure water to remove a produced salt and remaining fine particles.

The neutralized washed metal oxide filler is then separated and dried. It is preferable that the drying is carried out under clean atmosphere such as a clean gas. As the clean gas, for example, high purity inert gases such as nitrogen gas, helium gas and argon gas are preferably used. It is preferable that the filler is pre-dried at 50° to 150°C for 5 to 24 hours and then heated at 200° to 300°C for 1 to 24 hours.

The neutralizing treatment may be carried out by simply cleaning with a clean chemical solution such as ultrapure water or exposing to an ammonia gas besides the above-mentioned methods.

15 Examples of the preferred clean chemical solution to be used are ultrapure water which has a metal content of not more than 1.0 ppm and contains less than 300 fine particles of not less than 0.2  $\mu\text{m}$  per 1 ml, and an organic liquid at a cleaning temperature or an inorganic aqueous solution which has a metal content of not more than 1.0 ppm and

20 contains less than 200 fine particles of not less than 0.5  $\mu\text{m}$  per 1 ml.

The clean metal oxide filler of the present invention is added to a crosslinkable elastomer to give a crosslinkable elastomer composition. An adding amount of the filler is from 1 to 150 parts by weight (hereinafter referred to as "part"), preferably from 1 to 80 parts on the basis of 100 parts of the elastomer component. If the filler is added more, an amount of the filler to be falling away increases, which causes generation of particles.

The elastomer component is not limited particularly. When used as a starting material for a sealing member for semiconductor manufacturing equipment, a fluorine-containing elastomer or silicone elastomer is preferred.

5 Examples of fluorine-containing elastomer to be used preferably are elastomers capable of being crosslinked with a peroxide, imidazole, oxazole or thiazole crosslinking agent.

Examples of the fluorine-containing elastomer capable of being crosslinked with a peroxide crosslinking agent are as follows.

10 Perfluoro elastomer comprising 40 to 90 % by mole of tetrafluoroethylene, 10 to 60 % by mole of perfluoro(vinyl ether) represented by the formula  
(1):



15 wherein  $R_f$  is a perfluoroalkyl group having 1 to 5 carbon atoms or a perfluoroalkyl(poly)ether group having 3 to 12 carbon atoms and 1 to 3 oxygen atoms, and 0 to 5 % by mole of a monomer giving a cure site.

Vinylidene fluoride elastomer comprising 30 to 90 % by mole of vinylidene fluoride, 15 to 40 % by mole of hexafluoropropylene and 0 to 30 % by mole of tetrafluoroethylene.

Thermoplastic perfluoro elastomer which is a fluorine-containing multi-segment polymer comprising an elastomeric fluorine-containing polymer chain segment and a non-elastomeric fluorine-containing polymer chain segment, in which the elastomeric fluorine-containing polymer chain segment comprises 40 to 90 % by mole of tetrafluoroethylene, 10 to 60 % by mole of perfluoro(vinyl ether)

represented by the formula (1):



5 wherein  $R_f$  is a perfluoroalkyl group having 1 to 5 carbon atoms or a  
perfluoroalkyl(poly)ether group having 3 to 12 carbon atoms and 1 to 3  
oxygen atoms, and 0 to 5 % by mole of a monomer giving a cure site, and  
the non-elastomeric fluorine-containing polymer chain segment  
comprises 85 to 100 % by mole of tetrafluoroethylene and 0 to 15 % by  
10 mole of a compound represented by the formula (2):



wherein  $R_f^1$  is  $\text{CF}_3$  or  $\text{OR}_f^2$ , in which  $R_f^2$  is a perfluoroalkyl group having  
15 1 to 5 carbon atoms.

Fluorine-containing multi-segment polymer comprising an elastomeric  
fluorine-containing polymer chain segment and a non-elastomeric  
fluorine-containing polymer chain segment, in which the elastomeric  
fluorine-containing polymer chain segment contains recurring units  
20 derived from 45 to 85 % by mole of vinylidene fluoride and from at least  
one other monomer copolymerizable with vinylidene fluoride. Examples  
of the other monomer are hexafluoropropylene, tetrafluoroethylene,  
chlorotrifluoroethylene, trifluoroethylene, trifluoropropylene,  
tetrafluoropropylene, pentafluoropropylene, trifluorobutene,  
25 tetrafluoroisobutene, perfluoro(alkyl vinyl ether), vinyl fluoride, ethylene,  
propylene, alkylvinylether, and the like.

Cold resistant fluorine-containing elastomer prepared by radical

polymerization in the presence of a di-iodine compound and comprising 0.005 to 1.5 % by mole of iodine-containing fluorinated vinyl ether unit, 40 to 90 % by mole of vinylidene fluoride unit and 3 to 35 % by mole of perfluoro(methyl vinyl ether) unit (as case demands, 5 hexafluoropropylene unit up to 25 % by mole and/or tetrafluoroethylene unit up to 40 % by mole may be contained) (JP-A-8-15753).

Copolymer of tetrafluoroethylene and propylene (USP-3,467,635), and the like.

As the peroxide to be used as a crosslinking agent in such 10 peroxide crosslinking, those which have been used so far can be used. It is a matter of course that the peroxide which does not contain metal elements is preferred. Examples of the peroxide are 2,2-dimethyl-2,5-di(t-butylperoxy)hexane, and the like.

Fluorine-containing elastomers which are capable of being 15 crosslinked with an imidazole, oxazole or thiazole crosslinking agent can provide a molded article with very high heat resistance. Examples thereof are fluorine-containing elastomers containing a tetrafluoroethylene unit and the perfluoro(vinyl ether) unit represented by the above-mentioned formula (1) and having nitrile, carboxyl and/or 20 alkoxy carbonyl as a crosslinkable group.

Examples of perfluoro(vinyl ether) are perfluoro(methyl vinyl ether) (PMVE), perfluoro(ethyl vinyl ether) (PEVE), perfluoro(propyl vinyl ether) (PPVE), and the like. Among them, PMVE is preferred.

A proportion of the tetrafluoroethylene unit to the 25 perfluoro(vinyl ether) unit is 40 to 90/60 to 10 in % by mole.

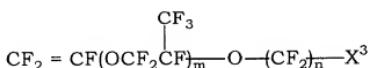
Examples of the crosslinkable group which gives reactivity for crosslinking to the fluorine-containing elastomer capable of being

crosslinked with an imidazole, oxazole or thiazole crosslinking agent are nitrile, carboxyl and/or alkoxy carbonyl. Examples of alkoxy carbonyl are methoxy carbonyl, ethoxy carbonyl, propoxycarbonyl, and the like. A content of the crosslinkable group is not more than 5 % by mole, 5 preferably not more than 2 % by mole.

Examples of the method to introduce such crosslinkable group are a method of copolymerizing a monomer having a crosslinkable group or a group convertible to a crosslinkable group (copolymerizing method), a method of converting a polymerization initiating moiety of 10 polymerization end to carboxyl (end group converting method), and the like.

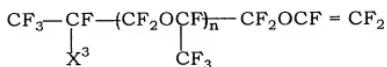
Examples of the monomer to be used for the copolymerizing method are a nitrile-containing monomer, carboxyl-containing monomer, alkoxy carbonyl-containing monomer, and the like represented by:

15



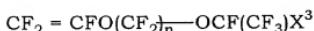
wherein m is 0 to 5 and n is 1 to 8,

20



wherein n is 1 to 4,

25



wherein n is 2 to 5,

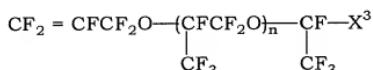


5 wherein n is 1 to 6,



wherein n is 1 or 2, and

10



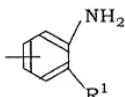
wherein  $\text{X}^3$  is CN, COOH or COOR<sup>5</sup>, in which R<sup>5</sup> is alkyl which may

15 contain fluorine atom having 1 to 10 carbon atoms.

In case where at least one of end groups is carboxyl or alkoxy carbonyl, it is preferable to copolymerize a monomer having nitrile or carboxyl from the viewpoint of crosslinking reactivity.

As a crosslinking agent to be used for the imidazole 20 crosslinking, oxazole crosslinking or thiazole crosslinking, it is preferable to use a compound having at least two amino groups. Particularly from the viewpoint of enhancing heat resistance, preferred is a compound having at least two functional groups represented by the formula (I):

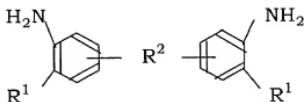
25



wherein R<sup>1</sup> is any one of OH, NH<sub>2</sub> or SH.

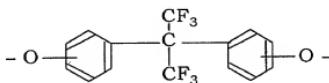
Examples of the compound represented by the formula (I) are compounds represented by the formula (II):

5



wherein R<sup>1</sup> is as defined above, R<sup>2</sup> is -SO<sub>2</sub>-, -O-, -CO-, alkylene having 10 to 6 carbon atoms, perfluoroalkylene having 1 to 10 carbon atoms, a single bond or a group represented by the formula (III).

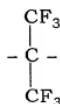
15



Positions of NH<sub>2</sub> and R<sup>1</sup> to phenyl group may be the same or different at both sides of the right and left functional groups (I).

Non-restricted examples of preferred alkylene of R<sup>2</sup> which may be substituted are, for instance, non-substituted alkylene having 1 to 6 carbon atoms, perfluoroalkylene having 1 to 10 carbon atoms, and the like. Examples of perfluoroalkylene are:

25



TOP SECRET - 14 -

and the like. Those R<sup>2</sup> are known as a bisdiaminophenyl compound raised in JP-B-2-59177 and JP-A-8-120146.

Though R<sup>2</sup> may be bonded to any positions of the both right and left benzene rings, it is preferable that either of NH<sub>2</sub> group or R<sup>1</sup> is so bonded as to be at a para position from the viewpoint of easy synthesis and advancing a crosslinking reaction easily.

Non-restricted examples of the crosslinking agent are, for instance, bisdiaminophenyl compound (for imidazole crosslinking) such as 2,2-bis-(3,4-diaminophenyl)hexafluoropropane, bis-(3,4-diaminophenyl)methane and bis-(3,4-diaminophenyl)ether; bisaminophenol compounds (for oxazole crosslinking) such as 2,2-bis-(3-amino-4-hydroxyphenyl)hexafluoropropane (generally called bis(aminophenol)AF); bisaminothiophenol compound (for thiazole crosslinking) such as 2,2-bis-(3-amino-4-mercaptophenyl)hexafluoropropane; and the like.

Those crosslinking agents give molded articles being excellent in mechanical strength, heat resistance and chemical resistance, particularly having well-balanced heat resistance and chemical resistance.

Examples of the preferred silicone elastomer are, for instance, a silicone rubber, fluoro silicone rubber, and the like.

The elastomer composition can be crosslinked into products having desired forms. As a crosslinking method, though the above-mentioned crosslinking with a peroxide, imidazole, oxazole or thiazole crosslinking agent is preferable, other known crosslinking methods, for example, methods of crosslinking with a triazine, polyol and polyamine

crosslinking agents, methods of crosslinking by irradiating radioactive rays and electron beams, and the like may be employed.

The crosslinking agent is added in an amount of from 0.05 to 10 parts (part by weight, hereinafter the same), preferably from 0.1 to 5 parts on the basis of 100 parts of the elastomer component and if necessary, the crosslinking accelerator is added in an amount of from 0.1 to 10 parts, preferably from 0.3 to 5.0 parts on the basis of 100 parts of the elastomer component. In addition, a processing aid, internal mold releasing agent, and the like may be added in an amount not lowering effect of the present invention.

The crosslinkable elastomer composition of the present invention can be suitably used for production of a molded article for semiconductor manufacturing equipment, particularly a sealing member for sealing of semiconductor manufacturing equipment which is particularly required to be highly clean. Examples of the sealing member are O-ring, square ring, gasket, packing, oil seal, bearing seal, lip type seal, and the like.

In addition, the crosslinkable elastomer composition can be used for a variety of elastomer products, for example, diaphragm, tube, 20 hose, various rubber rolls, and the like. Also the composition can be used as a coating material and a lining material.

The molded article of the present invention is suitable for a sealing member for sealing of a semiconductor manufacturing equipment used in a dry process such as a plasma etching equipment 25 mentioned hereinafter and also a sealing member for sealing of a semiconductor manufacturing equipment used in a wet process such as a cleaning equipment since elution of metals can be reduced.

With respect to the molded article suitable for dry process, an impurity metal content measured by an ashing analysis method is not more than 100 ppm, preferably not more than 50 ppm, and an increasing rate of particles generated by irradiating oxygen plasma is not more than 1,000 %, preferably not more than 500 %, more preferably not more than 200 %. It is preferable that the number of particles increased by irradiating oxygen plasma is not more than  $50 \times 10^4 / \text{cm}^2$ .

With respect to the molded article suitable for wet process, an amount of impurity metals extracted with  $H_2SO_4/H_2O_2$  (4/1 in weight ratio) is such that a total amount of Fe and Na does not exceed 8 ppb and that an amount of impurity metals other than silicon which is extracted with a 50 % aqueous solution of HF is not more than 200 ppb, preferably not more than 100 ppb.

In the present invention, the semiconductor manufacturing equipment is not limited to equipment for manufacturing semiconductors and encompasses whole manufacturing equipment used in the field of semiconductors where a high degree of cleanliness is required, such as equipment for manufacturing a liquid crystal panel and plasma panel.

20 Examples of the semiconductor manufacturing equipment are  
as follows.

### (1) Etching system

### Dry etching equipment (for dry process)

## Plasma etching machine (for dry process)

25 Reactive ion etching machine (for dry process)

## Reactive ion beam etching machine (for dry process)

### Sputter etching machine (for dry process)

09869900-07765

- Ion beam etching machine (for dry process)
- Wet etching equipment (for wet process)
- Ashing equipment (for dry process)
- (2) Cleaning system
  - 5 Dry etching cleaning equipment (for dry process)
    - UV/O<sub>3</sub> cleaning machine (for dry process)
    - Ion beam cleaning machine (for dry process)
    - Laser beam cleaning machine (for dry process)
    - Plasma cleaning machine (for dry process)
    - Gas etching cleaning machine (for dry process)
  - 10 Extractive cleaning equipment
    - Soxhlet extractive cleaning machine (for wet process)
    - High temperature high pressure extractive cleaning machine (for wet process)
  - 15 Microwave extractive cleaning machine (for wet process)
  - Supercritical extractive cleaning machine (for wet process)
- (3) Exposing system
  - Stepper (for wet process)
  - Coater and developer (for wet process)
- 20 (4) Polishing system
  - CMP equipment (for wet process)
- (5) Film forming system
  - CVD equipment (for dry process)
  - Sputtering equipment (for dry process)
- 25 (6) Diffusion and ion implantation system
  - Oxidation and diffusion equipment (for dry process)
  - Ion implantation equipment (for dry process)

(7) Cleaning system using hydrofluoric acid, hydrochloric acid, sulfuric acid, aqueous ozone, and the like (for wet process)

The present invention is then explained by means of examples, but is not limited to them.

5           Contents of impurity metals in the silicon oxide fillers which were used in the following examples and comparative examples are shown in Table 1.

(Contents of impurity metals in filler)

10          0.1 Gram of a silicon oxide filler is put in a platinum crucible, and after diffused and dissolved in 5 ml of 50 % hydrofluoric acid in a hot bath, is diluted with ultrapure water. Contents of metals of that solution were determined through atomic absorption analysis by using an atomic absorption photometer (Z8000 available from Hitachi, Ltd.). Metals intended to detect were metals shown in Table 1. Contents of 15 each metal in the filler were determined by the following equation.

$$\text{Metal content (ppm)} = \frac{\text{Concentration in solution (ppm)}}{\text{Weight of filler (g)}} \times \text{Weight of solution (g)}$$

20           EXAMPLE 1

A 6-liter stainless steel autoclave provided with no ignition source was charged with 2 liters of pure water, 20 g of  $\text{C}_7\text{F}_{15}\text{COONH}_4$  as an emulsifying agent and 0.18 g of disodium hydrogen phosphate·12 $\text{H}_2\text{O}$  as a pH regulator. After the inside of the system was replaced with 25 nitrogen gas sufficiently for deaeration, the autoclave was heated to 50°C with stirring at 600 rpm, and a mixed gas of tetrafluoroethylene (TFE) and perfluoro(methyl vinyl ether) (PMVE) (TFE/PMVE=20/80 in mole

ratio) was fed so that the inside pressure became 1.18 MPa·G. Then 2 ml of an aqueous solution containing ammonium persulfate (APS) in a concentration of 186 mg/ml was fed with pressurized nitrogen to initiate a reaction.

With advance of the polymerization, at the time when the inside pressure lowered to 1.08 MPa·G, 4.0 g of di-iodine compound  $I(CF_2)_4I$  was fed with pressurized nitrogen. Then a mixture gas of TFE and PMVE (mole ratio of 19/23) was fed under pressure by a plunger pump. After that, increasing and decreasing of the pressure were repeated between 1.08 MPa·G and 1.18 MPa·G.

At the time when a total feeding amount of TFE and PMVE reached 430 g, 511 g and 596 g, respectively, 1.5 g of  $ICH_2CF_2CF_2OCF=CF_2$  was fed under pressure. Also every 12 hours after the initiation of the polymerization reaction, 2 ml of an aqueous solution containing ammonium persulfate (APS) in a concentration of 35 mg/ml was fed with pressurized nitrogen to continue the polymerization reaction. The polymerization was terminated 35 hours after the initiation of the reaction.

The obtained aqueous emulsion was frozen in dry ice/methanol to be coagulated, and then after thawing, a precipitated product was washed with water and vacuum-dried to give an elastomeric copolymer. A Mooney viscosity  $ML_{1+10}$  (100°C) of the copolymer was 63.

As a result of  $^{19}F$ -NMR analysis, monomer units of the copolymer were TFE/PMVE=59.2/40.8 in % by mole, and an iodine content obtained by elementary analysis was 0.03 % by weight.

An elastomer composition of the present invention was

prepared by kneading 10 g of 1-FX (High purity synthetic quartz spheroidal silica available from Kabushiki Kaisha Tatsunori, average particle size: 0.38 $\mu$ m), 0.5 g of 2,5-dimethyl-di(t-butylperoxy)hexane (Perhexa 2.5B available from NOF Corporation) and 2.0 g of

5 triallylisocyanurate (TAIC) (available from Nippon Kasei Kabushiki  
 Kaisha) with 100 g of the obtained tetrafluoroethylene/perfluoro(alkyl  
 vinyl ether) copolymer elastomer. The composition was crosslinked  
 with a hot press (primary crosslinking) by compression-molding at  
 160°C for 10 minutes, and then crosslinked in an oven (secondary  
 crosslinking) at 180°C for four hours to give an O-ring (AS-568A-214).

The obtained O-ring was cleaned with sufficiently much amount of  $H_2SO_4/H_2O_2$  (4/1 in weight ratio) mixture solution at 100°C for 30 minutes with stirring and after rinsing with pure water, was dried under clean environment to give a sample O-ring.

With respect to the obtained O-ring, the number of particles was measured by the method mentioned below.

(Number of particles)

The sample was cleaned with a supersonic wave in ultrapure water at 25°C for one hour, and then the number of particles having a particle size of not less than 0.2 μm was measured by a fine particle meter method (a method of emitting light to ultrapure water containing particles which was flowed into a sensor part and then electrically measuring amounts of transmitted light and scattered light with a submerged particle counter (available from Kabushiki Kaisha Rion)).

$$\text{Number of particles released from O-ring } (/cm^2) = \frac{\left( \frac{\text{Total amount of ultrapure water (ml)}}{\text{Amount of pure water sampled in particle counter}} \right) \times \left( \text{Number of particles per one O-ring} \right)}{\text{Surface area per one O-ring (AS-568A-214) } (/cm^2)}$$

5 Subsequently plasma resistance test of the above-mentioned O-ring after washing was carried out by the method mentioned below to measure the number of particles after plasma irradiation to the O-ring. The results are shown in Table 2 together with an increasing rate of particles and a change in weight after the plasma irradiation.

10 (Plasma resistance test)

Plasma was generated under the conditions of a vacuum pressure of 50 mTorr, an oxygen flow of 200 cc/min, electric power of 400 W and a frequency of 13.56 MHz by using Plasma Dry Cleaner Model PX-1000 available from Kabushiki Kaisha Samco International 15 Kenkyusho, and the generated plasma was irradiated to a sample (O-ring) under the reactive ion etching (RIE) conditions for three hours.

Then amount of impurity metals extracted from the obtained O-ring was determined by the method mentioned below. The results are shown in Table 3 (extraction in  $H_2SO_4/H_2O_2$  (4/1 in weight ratio))

20 and Table 4 (extraction in 50 % HF).

(Metal extraction test)

(1) A vessel (with a lid) made of tetrafluoroethylene/perfluoro(alkyl vinyl ether) copolymer (so-called PFA) and sufficiently cleaned previously is charged with a given amount of chemical solution for extraction.

25 (2) The chemical solutions to be used are  $H_2SO_4/H_2O_2$  (4/1) mixture and a 50 % aqueous solution of HF. Both chemical solutions to be used are those having a grade for use in production of semiconductors.

(3) The obtained O-ring is cleaned with sufficiently much amount of H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O<sub>2</sub> (4/1 in weight ratio) mixture solution at 100°C for 30 minutes with stirring and after rinsing with pure water, is dried under clean environment to give a sample O-ring. The sample O-rings are  
5 dipped in the respective chemical solutions and after sealing, both solutions are kept at a given temperature for a given period of time (at 25°C for 14 days in case of H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O<sub>2</sub> (4/1) mixture and 25°C for 24 hours in case of a 50 % aqueous solution of HF). In that case, extraction of metals is compared with control solutions stored without  
10 dipping the samples therein.

(4) After storing the solutions for the above-mentioned period of time, concentrations of metals in the solutions were measured with ICP-MS (SPQ9000 available from Seiko Denshi Kabushiki Kaisha) in case of H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O<sub>2</sub> (4/1) mixture and with an atomic absorption photometer  
15 (Z-8000 available from Hitachi, Ltd.) in case of a 50 % aqueous solution of HF.

(5) Amounts of metals extracted from the O-ring were calculated by the following equation.

$$20 \text{ Amount of extracted metal (ppb)} = \frac{\left[ \text{Metal concentration in chemical solution (ppb)} \right] - \left[ \text{Metal concentration in control solution (ppb)} \right]}{\text{Weight of O-ring (g)}} \times \text{Weight of chemical solution (g)}$$

Further with respect to the obtained O-ring, contents of impurity metals were determined by the method mentioned below. The  
25 results are shown in Table 5.

(Contents of impurity metals)

0.5 To 2.0 grams of sample O-ring is put in a clean platinum

crucible, and heated at 600°C for two hours to be sufficiently ashed. Then 5 ml of 5 % by weight of hydrofluoric acid is added to the ash remaining in the crucible and heated and dissolved in a hot bath, followed by diluting with ultrapure water. Contents of metals of that solution were determined through atomic absorption analysis by using an atomic absorption photometer (Z8000 available from Hitachi, Ltd.). Metals intended to detect were metals shown in Table 1. Contents of each metal in the O-ring were determined by the following equation.

$$10 \quad \text{Metal content (ppm)} = \frac{\text{Concentration in solution (ppm)}}{\text{Weight of O-ring (g)}} \times \text{Weight of solution (g)}$$

#### COMPARATIVE EXAMPLE 1

An elastomer composition for comparison was prepared in the same manner as in Example 1 except that 10 g of high grade titanium oxide filler (TM-1 available from Fuji Titanium Industry Co., Ltd.) was used as a metal oxide filler instead of 1-FX. The composition was crosslinked in the same manner as in Example 1 to give an O-ring.

The number of particles before and after oxygen plasma resistance test of the O-ring was determined. The results are shown in Table 2.

#### COMPARATIVE EXAMPLE 2

An elastomer composition for comparison was prepared in the same manner as in Example 1 except that a mixture of 5 g of high grade titanium oxide filler (TM-1 available from Fuji Titanium Industry Co., Ltd.) and 5 g of 1-FX was used as a metal oxide filler instead of 1-FX.

The composition was crosslinked in the same manner as in Example 1 to give an O-ring.

The number of particles before and after oxygen plasma resistance test of the O-ring was determined. The results are shown in  
5 Table 2.

### COMPARATIVE EXAMPLE 3

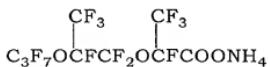
An elastomer composition for comparison was prepared in the same manner as in Example 1 except that 10 g of white carbon filler by  
10 wet process (CARPLEX #1120 available from Shionogi Seiyaku Kabushiki Kaisha) was used as a metal oxide filler instead of 1-FX. The composition was crosslinked in the same manner as in Example 1 to give an O-ring.

Amounts of extracted impurity metals of the O-ring were  
15 measured in the same manner as in Example 1. The results are shown in Table 3 (extraction in H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O<sub>2</sub> (4/1)) and Table 4 (extraction in 50 % HF).

Further impurity metal contents of the obtained O-ring were determined in the same manner as in the above-mentioned method of  
20 O-ring. The results are shown in Table 5.

### EXAMPLE 2

A 3-liter stainless steel autoclave provided with no ignition source was charged with 1 liter of pure water, 10 g of:



as an emulsifying agent and 0.09 g of disodium hydrogen phosphate·12H<sub>2</sub>O as a pH regulator. After the inside of the system was replaced with nitrogen gas sufficiently for deaeration, the autoclave was heated to 50°C with stirring at 600 rpm, and a mixed gas of 5 tetrafluoroethylene (TFE) and perfluoro(methyl vinyl ether) (PMVE) (TFE/PMVE=25/75 in mole ratio) was fed so that the inside pressure became 0.78 MPa·G. Then 10 ml of an aqueous solution containing ammonium persulfate (APS) in a concentration of 527 mg/ml was fed with pressurized nitrogen to initiate a reaction.

With advance of the polymerization, at the time when the inside pressure lowered to 0.69 MPa·G, 1.89 g of CF<sub>2</sub>=CFOCF<sub>2</sub>CF(CF<sub>3</sub>)OCF<sub>2</sub>CF<sub>2</sub>COOH (CBVE) was fed with pressurized nitrogen. Then 4.7 g of TFE and 5.3 g of PMVE were fed with their self-pressure. After that, with the advance of the reaction, TFE and 15 PMVE were fed under pressure in the same manner, and increasing and decreasing of the pressure were repeated between 0.78 MPa·G and 0.69 MPa·G. At the time when a total feeding amount of TFE and PMVE reached 80 g 4.2 hours after the initiation of the polymerization reaction, the autoclave was cooled and an un-reacted monomer was released to 20 give 1,089 g of an aqueous dispersion having a solid content of 7.5 % by weight.

Then 1,000 g of the aqueous dispersion was diluted with 3,000 g of water and slowly added to 2,800 g of aqueous solution of 3.5 % by weight of hydrochloric acid with stirring. After the addition, the 25 solution was stirred for five minutes and a precipitated product was filtrated. The obtained polymer was further added to 800 g of HCFC-141b, stirred for five minutes and then filtrated again. After that, the

steps of washing with HCFC-141b and filtrating were repeated four times, followed by vacuum-drying at 120°C for 72 hours to give an elastomeric copolymer.

As a result of  $^{19}\text{F-NMR}$  analysis, monomer units of the 5 copolymer were TFE/PMVE/CBVE=59.6/39.9/0.5 in % by mole.

An elastomer composition of the present invention was prepared by kneading 10 g of 1-FX (high purity synthetic quartz spheroidal silica) and 2.0 g of 2,2-bis(3,4-diaminophenyl)hexafluoropropane with 100 g of the obtained 10 tetrafluoroethylene/perfluoro(alkyl vinyl ether) copolymer elastomer. The composition was crosslinked with a hot press (primary crosslinking) by compression-molding at 200°C for 30 minutes, followed by crosslinking in an oven (secondary crosslinking) at 204°C for 18 hours and then at 288°C for 18 hours to give an O-ring (AS-568A-214).

With respect to the obtained O-ring, the number of particles before and after the oxygen plasma resistance test was determined in the same manner as in Example 1. The results are shown in Table 2.

TABLE 1

Impurity metal	Content (ppm)		
	High purity synthetic quartz	White carbon by wet process	Detection limit (ppm)
	Ex. 1 and 2	Com. Ex. 3	
Na	2	27000	0.002
K	0.4	800	0.03
Ca	2	100	0.03
Fe	1	2	0.04
Ni	0.1	9	0.05
Cu	1	1	0.01
Cr	0.2	1	0.01
Mg	2	3	0.005
Total	8.7	27916	-

TABLE 2

	Ex. 1	Ex. 2	Com. Ex. 1	Com. Ex. 2
Number of particles ( $\times 10^4/\text{cm}^2$ )				
Before plasma irradiation (A)	0.9	0.9	0.9	0.9
After plasma irradiation (B)	2.3	2.1	17.8	17.3
Number of increased particles (C=B-A)	1.4	1.2	16.9	16.4
Increasing rate (C/A $\times 100$ ) (%)	156	133	1878	1822

FD90020 - 05092020

TABLE 3

Impurity metal	Extracted amount (ppb)		Detection limit (ppb)
	Ex. 1 (High purity synthetic quartz spheroidal silica)	Com. Ex. 3 (White carbon by wet process)	
Fe	ND	10	5
Ni	ND	ND	3
Cu	ND	ND	1
Na	ND	9	3
K	ND	ND	4
Ca	ND	ND	1
Mg	ND	ND	1
Zn	ND	ND	1
Total	ND	19	-

TABLE 4

Impurity metal	Extracted amount (ppb)		Detection limit (ppb)
	Ex. 1 (High purity synthetic quartz spheroidal silica)	Com. Ex. 3 (White carbon by wet process)	
Fe	10	80	1
Ni	ND	20	3
Cu	ND	1	1
Na	5	1000	0.5
K	3	40	0.5
Ca	5	20	1
Mg	20	30	0.4
Zn	20	50	1
Total	63	1241	-

TABLE 5

Impurity metal	Content (ppm)		Detection limit (ppm)
	Ex. 1 (High purity synthetic quartz spheroidal silica)	Com. Ex. 3 (White carbon by wet process)	
5	Na	1	0.002
	K	3	0.009
	Ca	0.7	0.006
	Mg	0.3	0.002
	Fe	0.7	0.004
	Ni	0.1	0.005
	Cu	0.4	0.002
	Cr	2	0.003
Total		8.2	409

## INDUSTRIAL APPLICABILITY

The metal oxide filler mainly comprising a silicon oxide of the present invention can give an elastomer molded article which is very clean and excellent in plasma resistance, has an excellent property of metal-elution inhibition and is used suitably as a material for molded article for a semiconductor manufacturing equipment.

CLAIMS

1. (Amended) A crosslinkable elastomer composition which comprises a crosslinkable elastomer component and a metal oxide filler containing a silicon oxide filler in an amount of not less than 60 % by weight; said silicon oxide filler has a content of impurity metals other than silicon of not more than 100 ppm which is measured under the following conditions:

The silicon oxide filler is dispersed and dissolved in 50 % hydrofluoric acid and is diluted with ultrapure water. Contents of metals of the solution are determined through atomic absorption analysis by using an atomic absorption photometer.

2. The crosslinkable elastomer composition of Claim 1, wherein said metal oxide filler consists of the silicon oxide filler.

3. The crosslinkable elastomer composition of Claim 1 or 2, wherein said silicon oxide filler has quartz crystal structure.

4. The crosslinkable elastomer composition of any of Claims 1 to 3, wherein said silicon oxide filler is blended in an amount of from 1 to 150 parts by weight on the basis of 100 parts by weight of the elastomer component.

5. The crosslinkable elastomer composition of any of Claims 1 to 4, which contains a crosslinking agent and said silicon oxide filler in amounts of 0.05 to 10 parts by weight and 1 to 150 parts by weight, respectively on the basis of 100 parts by weight of the elastomer component.

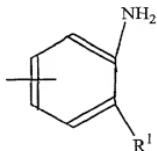
6. (Amended) The crosslinkable elastomer composition of any of Claims 1 to 5, wherein the elastomer component is a fluorine-containing elastomer.

7. The crosslinkable elastomer composition of Claim 6, wherein the elastomer component is a fluorine-containing elastomer capable of being crosslinked with a peroxide crosslinking agent.

8. The crosslinkable elastomer composition of Claim 6, wherein the elastomer component is a fluorine-containing elastomer capable of being crosslinked with an imidazole, oxazole, thiazole or triazine crosslinking agent.

9. The crosslinkable elastomer composition of Claim 6 or 7, wherein the crosslinking agent is an organic peroxide.

10. The crosslinkable elastomer composition of Claim 6 or 8, wherein the crosslinking agent is a compound having at least two functional groups represented by the formula (I):



wherein  $\text{R}^1$  is any one of OH,  $\text{NH}_2$  or SH.

11. A molded article obtained by crosslinking the elastomer composition of any of Claims 1 to 10.

12. The molded article of Claim 11, wherein an increasing rate of particles generated by irradiating oxygen plasma to the article is not more than 1,000 %.

5               13. The molded article of Claim 11, wherein an amount of impurity metals other than silicon which are extracted with a 50 % aqueous solution of HF is not more than 200 ppb.

10              14. The molded article of Claim 11, which contains impurity metals other than silicon in an amount of not more than 100 ppm.

15              15. The molded article of any of Claims 11 to 14, wherein the article is used for a semiconductor manufacturing equipment.

16. The molded article of Claim 15, wherein the article is a sealing member used for sealing of a semiconductor manufacturing equipment.

17. The molded article of Claim 13, wherein the article is a sealing member used for sealing of a semiconductor manufacturing equipment for wet process.

18. The molded article of Claim 17, wherein the article is a sealing member used for sealing of a semiconductor manufacturing equipment for a process with ultrapure water.

ABSTRACT

To provide a very clean elastomer molded article excellent in plasma resistance, having excellent property of metal-elution inhibition  
5 and is used suitably as a material for molded article for a semiconductor or liquid crystal manufacturing equipment. The molded article is obtained by crosslinking a crosslinkable elastomer composition comprising an elastomer component and a metal oxide filler comprising a silicon oxide filler containing impurity metals other than silicon in an  
10 amount of not more than 100 ppm. The molded article has an impurity metal content of not more than 100 ppm, and an increasing rate of particles generated by irradiating oxygen plasma to the article is not more than 1,000 % or an amount of impurity metals other than silicon which is extracted with a 50 % aqueous solution of HF is not more than  
15 200 ppb.

09339500 070604

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

特許出願宣言書  
Japanese Language Declaration

私は、下欄に氏名を記載した発明者として、以下のとおり宣言する：

私の住所、郵便の宛先および国籍は、下欄に氏名に続いて記載したとおりであり、

名称の発明に関し、請求の範囲に記載した特許を求める主題の本来の、最初にして唯一の発明者である（一人の氏名のみが下欄に記載されている場合）か、もしくは本来の、最初にして共同の発明者である（複数の氏名が下欄に記載されている場合）と信じ、

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

---

---

---

その明細所を  
(該当する方に印を付す)

ここに添付する。

\_\_\_\_\_日に出願番号第  
\_\_\_\_\_号として提出し、  
\_\_\_\_\_日に補正した。  
(該当する場合)

私は、前記のとおり補正した請求の範囲を含む前記明細書の内容を検討し、理解したことを陳述する。

私は、連邦規則法典第37部第1章第56条(a)項に従い、本願の審査に所要の情報を開示すべき義務を有することを認める。

CROSSLINKABLE ELASTOMER COMPOSITION  
AND MOLDED ARTICLE PRODUCED FROM  
SAME

the specification of which  
(check one)

is attached hereto  
was filed on PCT International  
Appln. Ser. No. PCT/JP00/00055  
and was amended on  
(if applicable)

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendments referred to above.

I acknowledge the duty to disclose information in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

私は、合衆国法典第35部第119条にもとづく下記の外国特許出願または発明者証出願の外国優先権の利益を主張し、さるに優先権の主張する基準の出願日を有する外国特許出願または発明者証出願を以下に明記する：

Prior foreign applications:  
先の外国出願：

Number 番号	Country 国名	January 12, 1999 Filing date 出願の年月日	<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
Number 番号	Country 国名	Filing date 出願の年月日	<input type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
Number 番号	Country 国名	Filing date 出願の年月日	<input type="checkbox"/> Yes あり	<input type="checkbox"/> No なし

私は、合衆国法典第35部第120条にもとづく下記の合衆国特許出願の利益を主張し、本願の請求範囲各項に記載の主題が合衆国法典第35部第112条第1項に規定の態様で先の合衆国出願に開示されていない限りにおいて、我が国内の間に公表された連邦規則法典第37部第1章第56条(a)項に記載の所要の情報を開示すべき義務を有することを認める：

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Priority claimed  
優先権の主張

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112. I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior of the prior application and the national or PCT International filing date of this application:

Appln. Ser. No. 出願番号	Filing Date 出願日	Status (patd., pend., abndnd.) 現況(特許済み、係属中、放棄済み)
Appln. Ser. No. 出願番号	Filing Date 出願日	Status (patd., pend., abndnd.) 現況(特許済み、係属中、放棄済み)

と実よたら001にの悪しのとつ  
も真おっさつ100編ら故い許こ行  
にて釋行、行第禁れる等るを  
識べて信じを部はこか爾るある  
知すべる事18はか本れが陳  
のがす從と述第したがきとの。  
己述有する陳典もまま述と上る  
自陳のろあん法金、陳付う以す  
にた己で偽國罰かれのてな、言  
こつと実虛り、るき偽處をしきを  
こ行、る其に合れ、國虚対をしきを  
、てりずが意、よら併るに性識と  
はあい信述故合にせがよ願効認と  
私づてび陳に場条処刑に本者をた

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

し任と為と  
と選こ行こ  
者にるのう  
明こす切行  
発こ行一して  
記を述るし  
下人をす対  
、理懈序は  
は代手に序。  
私ののれ標る  
私のは代序。

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

hereby appoint John H. Mion, Reg. No. 18,879; Donald E. Zinn, Reg. No. 19,046; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Robert G. McMorrow, Reg. No. 19,093; Louis Lubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703; John R. Inge, Reg. No. 26,916; Joseph J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,665; Alan J. Jasper, Reg. No. 25,426; Kenneth J. Burchfiel, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannan, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; and Brett S. Sylvester, Reg. No. 32,765, my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to **SUGHRUE, MION, ZINN, MACPEAK & SEAS**, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3202.

Full name of sole or first inventor  
第一のまたは第一の発明者の氏名(ローマ字)

Hiroyuki TANAKA

#### 第二のまたは第一の発 Inventor's signature

1105  
Date

1付 June 27, 2001

Inventor 同發明書の

## Citizenship

— 7 —

Residence  
住處 Sotetsu-shi OSAKA

511 • 2

住所 sett-su-shi, OSAKA  
Post office address

三

— 1 —

Post office address  
郵便の窓口 s/s Yodogawa

INDUSTRI

C/S 1000g  
Nishibito

OSAKA 566-85

## JAPAN

Full name of second joint inventor (if any)  
第2の共同発明者の氏名(該当する場合)(ローマン) Masanori HASEGAWA  
Second Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
同第2発明者の署名 Masanori Hasegawa 日付 June 27, 2001  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
住所 Settsu-shi, OSAKA 566-8585 JAPAN 国籍 Japanese  
Post office address \_\_\_\_\_  
郵便の宛先 c/o Yodogawa-seisakusho, DAIKIN INDUSTRIES, LTD., 1-1,  
Nishihitotsuya, Settsu-shi, OSAKA 566-8585 JAPAN

Full name of third joint inventor (if any)  
第3の共同発明者の氏名(該当する場合)(ローマン) Tsuyoshi NOGUCHI  
Third Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
同第3発明者の署名 Tsuyoshi Noguchi 日付 June 27, 2001  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
住所 Settsu-shi, OSAKA 566-8585 JAPAN 国籍 Japanese  
Post office address \_\_\_\_\_  
郵便の宛先 c/o Yodogawa-seisakusho, DAIKIN INDUSTRIES, LTD., 1-1,  
Nishihitotsuya, Settsu-shi, OSAKA 566-8585 JAPAN

Full name of fourth joint inventor (if any)  
第4の共同発明者の氏名(該当する場合)(ローマン) Katsuhiko HIGASHINO  
Fourth Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
同第4発明者の署名 Katsuhiko Higashino 日付 June 27, 2001  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
住所 Settsu-shi, OSAKA 566-8585 JAPAN 国籍 Japanese  
Post office address \_\_\_\_\_  
郵便の宛先 c/o Yodogawa-seisakusho, DAIKIN INDUSTRIES, LTD., 1-1,  
Nishihitotsuya, Settsu-shi, OSAKA 566-8585 JAPAN

Full name of fifth joint inventor (if any)  
第5の共同発明者の氏名(該当する場合)(ローマン) \_\_\_\_\_  
Fifth Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
同第5発明者の署名 \_\_\_\_\_ 日付 \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
住所 \_\_\_\_\_ 国籍 \_\_\_\_\_  
Post office address \_\_\_\_\_  
郵便の宛先 \_\_\_\_\_

Full name of sixth joint inventor (if any)  
第6の共同発明者の氏名(該当する場合)(ローマン) \_\_\_\_\_  
Sixth Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
同第6発明者の署名 \_\_\_\_\_ 日付 \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
住所 \_\_\_\_\_ 国籍 \_\_\_\_\_  
Post office address \_\_\_\_\_  
郵便の宛先 \_\_\_\_\_